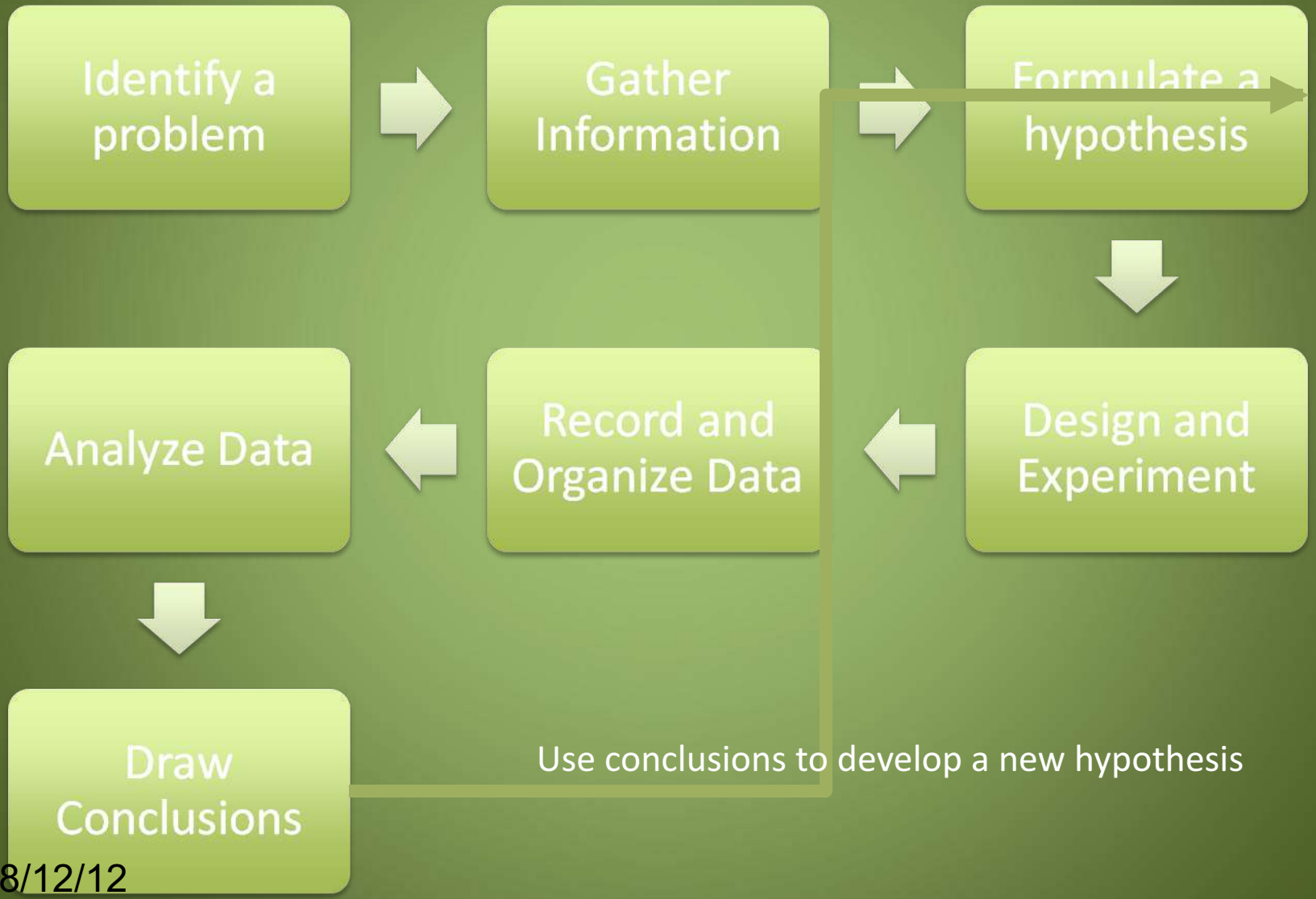
Steps of the Scientific Process

SPICE – University of Florida

Introduction to the Scientific Process

- A logical, **problem solving** technique

Introduction to the Scientific Process



Step 1: Identify a Problem

- Observe the world around you
- Using **observations**, identify a problem you would like to solve
  - Example: Why do te ine?
- This is a quest the answer to and can't loc
- "Why" and are good beginnings o

Remember?

Observation

- Uses our **senses** to gather information
- **Qualitative**: uses our 5 senses
  - The termites follow a circle made with a blue pen on white paper
- Quantitative: uses **number**s
  - 3 termites follow a circular blue pen line that is 5 cm in diameter

Inference

- A logical interpretation of events based on prior **knowledge** or **opinion**
  - Educated guess
- Termites follow the blue line because the like it.

Do we use observations or inferences when identifying a problem?

Step 2: Gather Information

- Use references to do background research
  - Books
  - Journals
  - Magazines
  - Internet
  - TV
  - Videos
  - Interview Experts

- Example: Termites
  - Live underground
  - Don't have compound eyes (can only see light and dark)

Step 3: Formulate a Hypothesis

Hypothesis

- Possible answer to a question that can be tested
- based on **observations** and knowledge
- "If" "Then" "Because" statement

Example: Termites

- Termites:
  - I hypothesis that ***if*** the termites follow a dark colored pen on a dark background ***then*** they follow the dark pen on a light background ***because*** of the color contrast since they see light and dark, but not color.

Do we use observation or inference to formulate a hypothesis?

Step 4: Develop an Experiment

Materials:

- **A list of all the things you need**
- Supplies

Procedure

- Step by step instructions
- Identifies the variables used in the experiment

How would you describe how to make a Peanut Butter and Jelly Sandwich to someone who had never done it?

To someone who didn't know what peanut butter or jelly is?

Variables: Independent Variable

- The variable **I** (the scientist) change or manipulate
- Examples:
  - The color of paper under the termites
  - The color of pen used
  - The brand of pen used

Variables: Dependent Variable

- Is **measured** in the experiment
- Changes because of the independent variable
- "Depends" on the independent variable
- Examples:
  - Does the termite follow the line (yes/no)
  - How many termites follow the line (whole number)
  - How long do the termites follow the line (time)

Variables: **Constant**

- All the factors in the experiments that are kept the **same**
- Everything except the independent variable
- Keeps the experiment 'fair'

Examples:

- If you test color of paper, keep the color of pen constant
- If you test the smell of pen, keep the color and type of pen constant (only change smell)
- The exact termites used
- The time of day and how long the termites are there
- The shape of the line drawn

Variable: **Control**

- The normal condition that you compare the other conditions to
- Recreate the conditions you first observed
- Example:
  - Termites in a Pitri dish on white filter paper and draw a blue line with a bic pen in the same shape as before.

Step 5: Record and Organize Data

- Write all observations and measurements
- Use a table to organize your data
  - List your **independent** variable on the left side
  - Record your dependent variables on the **right side**
- If you have more than one dependent variable, use a new column for each dependent variable

Independent Variable	Dependent Variable: Did they follow the line?
Blue ink on white paper	Yes/No
Blue ink on black paper	Yes/No

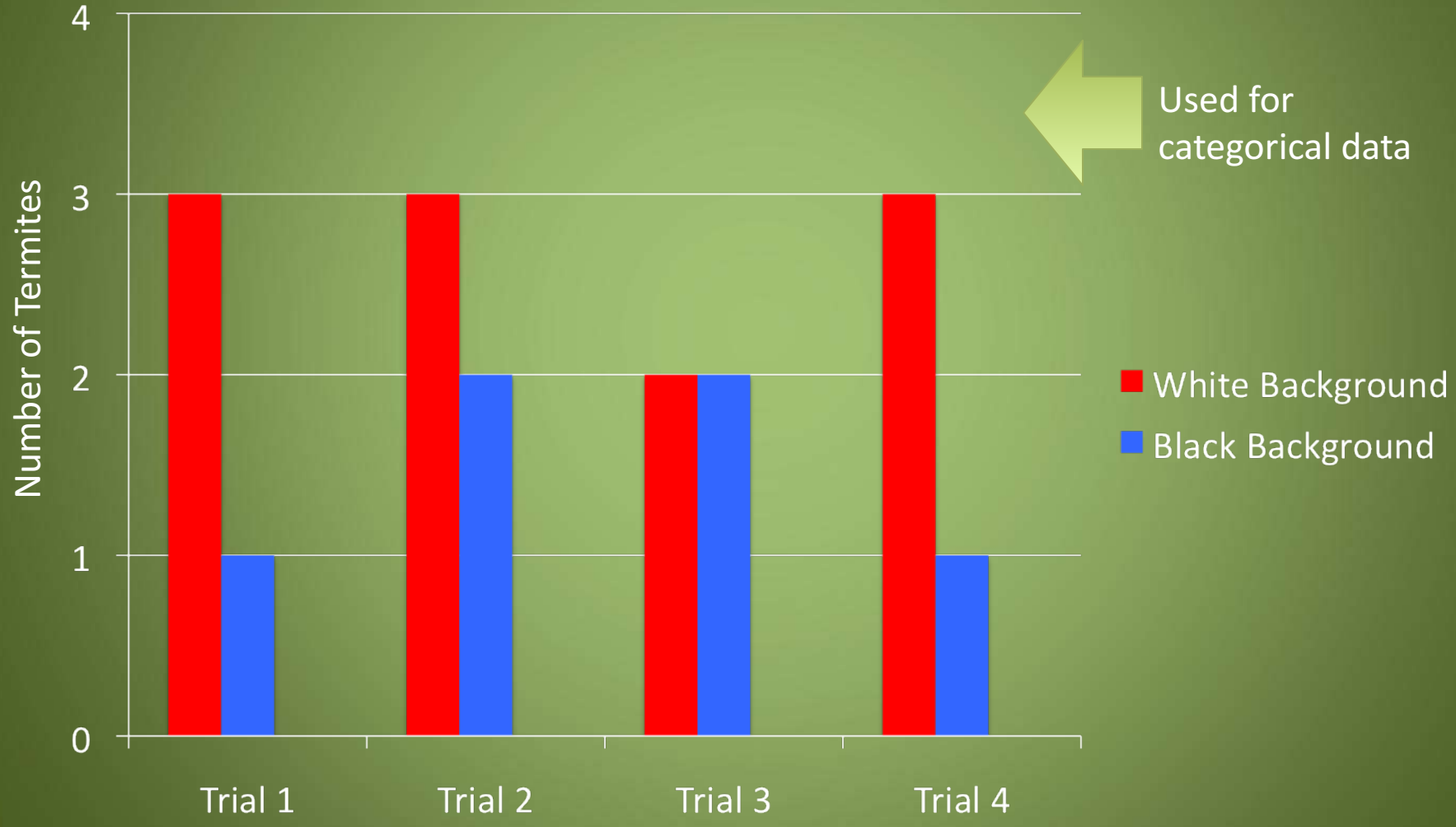
Which one of these independent variables is the control?

Which part of the independent variable is the constant?

Step 6: Analyze Data

- “A picture is worth a thousand words”
- Compare and look for trends and patterns using graphs

Bar Graph



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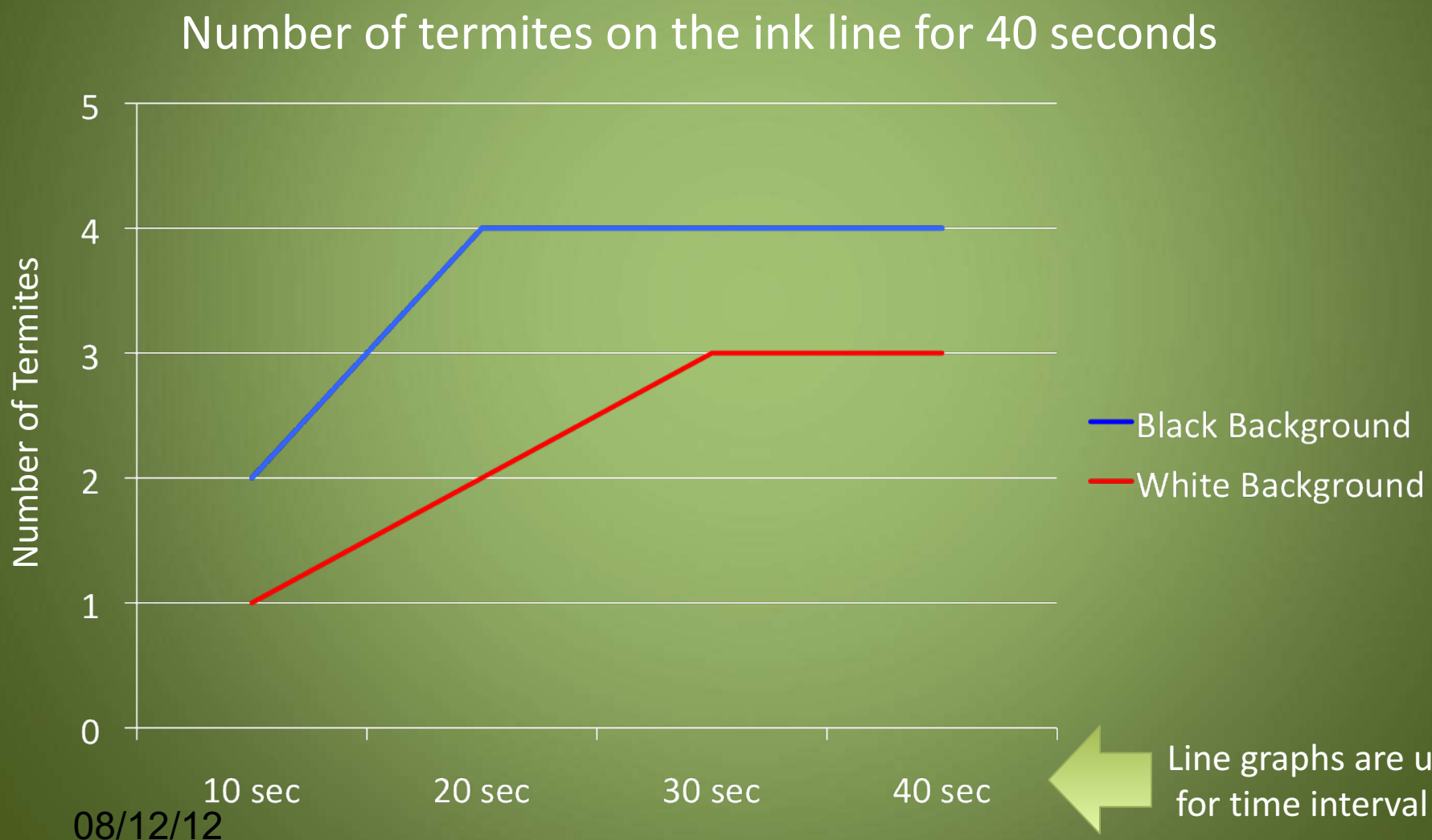
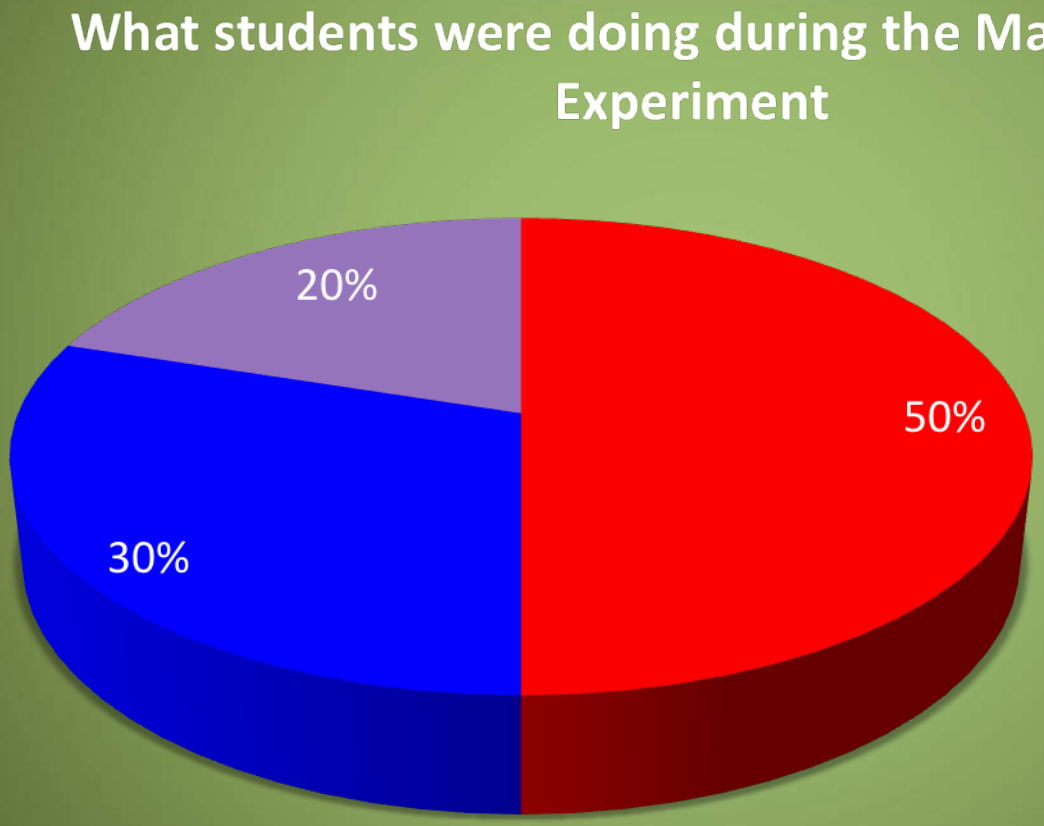
Line Graph



Line graphs are used for time interval data

Pie Chart



A Pie Chart adds up to a whole – 100% or all of something

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Step 7: Make Conclusions

- You must repeat the experiment to make the data valid
- You should run your experiment at least **3** times to confirm your results
  - You can run all the experiments at one time, or run one after the other
- Each separate experiment is called a **Repetition** (or Rep).

How many times?